CHAPTER 1
INTRODUCTION

1.1 Background

The World Health Organization (WHO) has declared a global pandemic status for Covid-19. This causes various sectors of human life to be disrupted, for example, the education sector. This causes a lot of problems in practical courses. lecturers must innovate both from the learning process or learning media to make online practical more effective (Elfizon, Mukhlidi Muskhir, 2017).

Learning media is one of solutions in overcome learning problems. For example, explaining the subject matter or abstract objects (Prihatmoko, 2016). Therefore, learning media must pay attention to the suitability of the subject matter, the accuracy of the media content with the content of the subject matter, and the quality of the learning media (Yanto et al., 2019).

Practical activities are very important because it can increase student's motivation, understanding, and personal skills (Fujii & Koike, 2017). Practical activities are usually done by accessing laboratory equipment directly to enhance student skills (Shweta et al., 2019). However, in the Covid 19 pandemic, it will be difficult because study must be done online (Indrayana & Sadikin, 2020).

Internet technology can be one of solutions to overcome these problem. A laboratory that uses internet technology to access it can be called an online laboratory. An online laboratory can be distinguished into a virtual laboratory and remote laboratory (remote lab) (Kamruzzaman et al., 2015). In a virtual laboratory, students are only given access to execute simulations, so no laboratory equipment are directly accessed (Kalashnikov et al., 2017). while in remote laboratories, students are given access to remote of laboratory equipment using internet connections (Haritman et al., 2018).

At the industrial electronics laboratory, Universitas Pendidikan Indonesia, there are no remote accessible training kit includes basic programming, sensor readings and monitoring (Shweta et al., 2019). To overcome such issues, the development

of a remote IoT laboratory would benefit students in IoT practical work. IoT32 uses over the air (OTA) technology on ESP32 to upload programs remotely and uses ESP32 CAM to live-view IoT hardware.

1.2 Research Problem

Based on the background, the formulations of the problems are:

1. How the development of the IoT32 training kit is?
2. How participants respond to the IoT32 training kit do?

1.3 Research Objectives

Based on the description of the research problems, the objectives of this research are as follows.

1. Researcher wants to develop an IoT32 training kit in the Embedded Systems and IoT courses at the Industrial Electronics Specialization for Electrical Engineering of Education, Universitas Pendidikan Indonesia.
2. Researcher wants to know participants response regarding the IoT32 training kit in the Embedded Systems and IoT courses in the Industrial Electronics Specialization of Electrical Engineering Education, Universitas Pendidikan Indonesia.

1.4 Problem Limitation

In this research, it is necessary to have a problem limitation to focus on researching the core of the problem objectively and with direction. For this reason, the researcher limits the problem as follows:

1. The application of the IoT32 training kit is carried out in the basic discussion of programming, sensor reading, and monitoring using ESP32 in embedded systems and IoT courses.
2. This research did not examine the learning improvement of students.

3. The research was conducted on students of the Electrical Engineering Education Universitas Pendidikan Indonesia in Industrial Electronics specialization, batch 2018.
4. The level of evaluation measured by the ADDIE approach is only limited to the first level, that is the level of students response after using the training kit.

1.5 Research Benefits

The following are the research benefits.

1. This research outcome can be used as reference for creating an effective and efficient learning process in the classroom, especially in the Electrical Engineering Education major at the Universitas Pendidikan Indonesia.
2. It can be used to contribute to the development of science, especially the application of IoT training modules based on ESP32 and OTA in the field of education.
3. It can be used as the reference of the development of IoT training material or module.

1.6 Undergraduate Thesis Organizational Structure

The systematic of this undergraduate thesis consists of several chapter. the first chapter is introduction, it consists of background problems, problem formulation, research objectives, problem boundaries, research benefits, and writing systematics. the second chapter is literature review, it consists of background problems, problem formulation, research objectives, problem boundaries, research benefits, and writing systematics. the third chapter is research method, it describes the research methods and design used, the time and place of research, the procedures and research flow, research instruments, instrument testing, data collection techniques, and data analysis techniques. the fourth chapter is result and discussion, it contains the analysis and discussion of research results, and research findings. the last chapter is conclusions, and recommendations. It contains conclusions, recommendation, and suggestions based on the research result.